very great interest. At present, and before we know the exact conditions under which the experiments were performed, it is impossible to form a correct judgment as to their value. The number of repetitions, and, in fact, all the details of the work, are needed in order to a just estimate of its correctness.

THE SCIENTIFIC PRINCIPLES OF AGRICULTURE.

UNDER the will of its founder, the Sherardian professor of botany in Oxford university was to hold also the Sibthorpian professorship of rural economy. The duties of both, but of the latter more particularly, were performed by Dr. Daubeny while he held this honorable post. His immediate successor, we suppose, gave his attention to the botanical chair; and the present incumbent, holding the ancient Sherardian professorship only, will doubtless give a fresh impulse to botanical study in the university. Under a chancery decree, the Sibthorpian professorship of rural economy is now independently established, and its duties defined "to lecture on the scientific principles of agriculture;" the amount of service is raised from 'one public lecture in each term' to twelve lectures annually; and Dr. Gilbert, for forty years the associate of Mr. Lawes at Rothamsted, and still so associated, was called to fill the chair. The continuous and well-concerted work done by these two men during the last forty or fifty years is now fairly well known and appreciated in all scientific circles; thanks, especially, to the extensive publication of a great part of the results in the Transactions of the Royal society. Mr. Lawes began his systematic investigations, we believe, while he was an undergraduate, more than half a century ago, by experimenting with manuring substances upon plants in pots; and when in 1834, on attaining his majority, he came into hereditary possession of the manor of Rothamsted, he at once set on foot the systematic experiments which are still in progress. It is understood that he has made ample provision for their continuance in the future. Although it could add nothing to his scientific fame, it was in fitting recognition of his services to his country that this inheritor of a handsome landed estate and a noble old manor-house was recently made a baronet. Equally fitting it is that Dr. Gilbert should now be called upon to present, in comparatively untechnical form, the general results and applications of his accumulated knowledge, and to inform the minds of those who will in great part become landlords, or country clergymen, or statesmen, to whom such instruction will form a proper and a very important part of a liberal education.

Dr. Gilbert's numerous scientific associates and personal friends in the United States, and not least those who had the pleasure of meeting him during his two visits to this country, while they read with interest the inaugural lecture delivered last spring, are hoping to have before them, in due time, the remainder of the course so happily begun, also its prospective continuation, to take the place in our day which was filled forty years ago by Johnston's lectures on agricultural chemistry and geology. 'A good deal has happened since then,' of which Dr. Gilbert can give excellent account. As an introduction to such an account, and to a popular exposition of the results attained during this interval, — much of it at Rothamsted, — nothing can well be more fit than this inaugural lecture. Agriculture is well said to be 'the concentrated production of food;' and the scientific principles upon which improvements in the art of concentrated production depend are drawn from the chemistry of the soil and atmosphere, and the chemistry along with the physiology of vegetation and of animal life. Of course, the subject will be treated by the present Sibthorpian professor from the chemical side. In this lecture the history of the subject is sketched from Saussure's analysis of plant-ashes in 1804, and Priestley's discovery of oxygen and of its liberation by growing plants, down to the researches of Liebig and Dumas, and ending with a sketch of the systematic field and laboratory work which has been carried on now for forty years by Sir John Lawes and himself. For the details of these prolonged experiments, and the full discussion of the results, see the elaborate memoirs published last year in the Transactions of the Royal society of London.

Introduction to the study of the scientific principles of agriculture: being the inaugural lecture delivered May 6, 1884, at the University museum, Oxford. By JOSEPH HENRY GILBERT, Ph.D., LL.D., Sibthorpian professor of rural economy, etc. 47 p. 8°.

CHADBOURNE ON INSTINCT.

PROF. P. A. CHADBOURNE'S Lowell lectures on instinct have reached a second edition; but the author has neither seen reason to alter the statements of the first edition, nor found time

Instinct: its office in the animal kingdom, and its relation to the higher powers in man. By P. A. CHADBOURNE. [Second edition.] New York, *Putnam's sons*, 1883. 323 p. 12°.

to incorporate in this one the new material that, as he tells us, he has prepared for a continuation of his discussion. This new material is to appear soon in another form; and, until it appears, we must postpone any detailed criticism in these columns of our author's known views. That the book contains much fair discussion of theories, and a very readable collection of facts, is plain enough; and, on the other hand, one need not dwell on the consideration, that, in their present form, these lectures cannot be considered as abreast with the advance of so rapidly growing a study as this. We shall add here only one criticism; namely, that there is, in this work, one obvious imperfection that has especially to do with our author's principal purpose itself. Professor Chadbourne studies instinct in animals that he may throw more light on the place and relations of instinct in man. But, just when he comes to speak of human nature, his psychological foundation is so antiquated, that all his learning helps us, his readers, but a little way. It is the old schematized and abstract psychology that is in his mind throughout, with its 'rational' and 'moral natures' of man, with its more or less complex scheme of subdivisions in each of these 'natures,' and with its notion of an abstractly defined hierarchy of human powers. For very elementary instruction, not in psychology as such, but in morals, this old psychology will still do well enough, no doubt, as a sort of rough working hypothesis; but the scheme is unreal, and modern psychology finds little use for it.

For this reason it is, that, when our author draws an elaborate parallel between the functions of the sense of obligation and those of the instincts, we feel that the undoubted actual likeness of these two sets of phenomena is distorted in his description, for the sake of fitting the facts to an *a priori* notion about the 'higher spiritual nature' of man. When he gives us an elaborate diagram, representing the place of the instincts among human faculties, we feel that this diagram represents a sort of stuffed soul, badly mounted, as it were, and no living soul of man at all. When, again, an argument for immortality peeps out from behind our author's classification of the belief in immortality as an instinctive human belief; when, in fact, we are told that one instinct ought to be as well founded as another, and that the belief in immortality is as much an instinct as is the instinct of an insect to lay eggs in autumn, — we feel only a sense of vexation that an ill-conducted analysis of human nature, accepted by our author from tradition, should be used by him for such a purpose in a scientific course of lectures. Why mix together utterly separate lines of consideration? Our belief in the real goodness of things, and in the worth of life, gains no whit, and can only lose force, by being confused with investigations into external physical phenomena, or even into the laws of the sequence of mental states. That tradition has long since sanctioned this confusion is no justification for it here.

RECENT TECHNICAL BOOKS.

CAIN's algebra contains two entirely distinct essays. In the first of them, with the hope of making the treatment of negative quantities clear to the student of elementary mathematics, the author represents real quantities in the usual way, — by lengths laid off upon a straight line, towards the right from a fixed origin on the line if the quantities are positive, towards the left if they are negative, — and develops successively the rules for algebraic addition, subtraction, multiplication, and division, by the help of this concrete conception. The rules thus obtained are then shown to be generally applicable to all problems, whether the difference between positive and negative quantities in them is one of opposition in direction or not; and the essay closes with some remarks on the generality of formulas of trigonometry and analytic geometry proved for a single case.

In the second essay, Professor Cain describes some methods common to all sciences of reasoning, compares and illustrates by examples the analytical and synthetical methods for the solution of problems, and finally discusses a few examples in finding the equation of loci, where some solutions are lost in the course of the work, or where some strange ones are introduced. The distance of the point P' from the point P seems to be written indifferently PP' or $P'P$. The little book would doubtless prove interesting and suggestive to any student

symbolic algebra, or the algebra of algebraic numbers, together with critical notes on the methods of reasoning employed in geometry. By Prof. W. CAIN, C.E. New York, *Van Nostrand*, 1884. (Van Nostrand's sc. ser., No. 73.) 131 p. 18°.

Testing-machines: their history, construction, and use. By ARTHUR V. ABBOTT. New York, *Van Nostrand*, 1884. (Van Nostrand's sc. ser., No. 74.) 190 p. 24°.

stadia surveying: the theory of stadia measurements, accompanied by tables for the reduction of stadia field-observations. By ARTHUR WINSLOW. New York, *Van Nostrand*, 1884. (Van Nostrand's sc. ser., No. 77.) 148 p. 24°.

The steam-engine indicator, etc. By W. B. LE VAN. New York, 1884. (Van Nostrand's sc. ser., No. 78.) 169 p. 24°.